Do shade nets ease the burn or do they burn a hole through your pocket?

Findings of a study in the EGVV on the use of shade netting to reduce sunburn in apple.

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Why did we do the work?

Sunburn is the major defect of apples produced for the fresh markets under the warm growing conditions in South African. Affected fruits are characterized by bleached or golden brown discoloured areas or, in its most severe form, necrosis of the peel. Since the visual appearance of the fruit plays an import part in the consumer preference, affected fruit are downgraded. In 'Granny Smith', which is very susceptible to sunburn and where even the slightest bleaching is visible, the pack out may be as low as 40% (personal communication: Two a Day technical team).

Sunburn is caused by high light levels and high fruit peel temperatures. Sunburn browning occurs at a peel temperature of 48 ºC while 10 minutes above 50 ºC is enough to kill peel cells resulting in necrosis. These seem like very high temperatures, but bear in mind that radiant heating may increase the fruit surface temperature by up to 16 ºC above air temperature. Shade nets decrease sunburn by decreasing the light exposure and thereby also the radiant heating of the fruit peel. This makes shade netting the most effective means to reduce sunburn on apples.

In 2007, Two-a-Day Pty Ltd and Vegtech initiated a project to evaluate the production of different apple cultivars under shade nets in the Elgin, Grabouw, Vyeboom, Villiersdorp (EGVV) area. Funding for the project was obtained from HORTGRO Science. Different coloured nets were used in the trials; however, we here only present the effects of the netted strips (nets) to uncovered (control) strips.

What did we do?

Full-bearing 'Granny Smith', 'Cripp's Red', 'Cripp's Pink' and 'Fuji' orchards on were selected in the EGVV area. Alternating double rows of 'Granny Smith' on MM109, 'Cripp's Red' on M25 and 'Cripp's Pink' on M25 were covered in an orchard of producer (6), while alternating double rows of 'Granny Smith' and 'Fuji' on M793 were covered in an orchard of producer (66). 'Fuji' trees on a M25 were also covered at producer (41). An area of approximately 0.5 ha was covered with horizontal nets. Adjacent uncovered trees served as control. There were at least 5 replicates for each treatment. Data were collected only from central trees at each stip.

Vigor control was adjusted under the nets, but irrigation, nutrition and all other orchard practices were managed the same as the control. Pearl, white, yellow and red nets were supplied by Vegtech while Knittex supplied a blue net. The nets were all classified as 20% shade net, which means that 20% of the area covered by the net consists of the net material; the amount of light absorbed by the nets differs based on the absorbance characteristics of the net material, i.e. a 20% black net absorbs more light than a 20% white net. Please refer to the suppliers for specifications on the different nets.

What did we find?

'Granny Smith'

Fig. 1 shows that the nets substantially reduced the incidence of sunburn in 'Granny Smith'. On average, sunburn at the 'Granny Smith' (6) site was reduced by 25% per annum over a 4 year period. At the Granny Smith (66) site, sunburn was reduced to lesser extent due to intermittent net coverage. The decrease in sunburn directly reflected in a considerable increase and decrease in the percentage class 1 and 3 fruit, respectively (Fig. 2). The average yield for netted 'Granny Smith' remained relatively unchanged compared to the uncovered strips (Fig. 3).

'Cripp's Red', 'Cripp's Pink' and 'Fuji'

Netting almost completely eliminated sunburn in 'Cripp's Red' and 'Cripp's Pink' and reduced sunburn in 'Fuji' by ±10% on average (Fig.1). On the downside though, the nets also decreased fruit red colour resulting in a large increase in the percentage of poorly coloured fruit (Fig. 4). The average yields of 'Cripp's Red' and 'Cripp's Pink' increased under the nets (Fig. 3). The increase in yield was ascribed to an increase in tree bearing area under the nets due to an increase in shoot growth. The effect on 'Fuji' yield and pack out was variable over the different seasons and alternative bearing in the last season resulted in yield losses under the nets. Previous research has shown that 'Fuji' shows a very strong growth response to netting (Smit, 2007) and this may have a detrimental effect on both fruit red colour and yield regularity.

In 'Cripp's Pink', the slight decrease in sunburn (± 6 %) did not compensate for the loss in red colour (± 20 %) despite the slight increase in yield observed in some years. More class 2 and 3 and less class 1 were produced (Fig. 2). In 'Cripp's Red', the decrease in fruit with adequate red colour was evened out by the reduction in sunburn. Hence, due to the increase in yield, nets increased the class 1 fruit produced.

So what's the net result?

- It makes economic sense to cover new 'Granny Smith' plantings under nets. The reduction in sunburn alone justifies the considerable cost of netting.
- Older 'Granny Smith' orchards may also benefit from a reduction in sunburn under nets. Nets may also invigorate worn out 'Granny Smith' orchards, resulting in a potential yield increase.
- The reduction in sunburn in less sunburn-sensitive and in red and blushed cultivars does not justify the cost of netting. The economics may improve for orchards on dwarfing rootstocks like M9 or GENEVA222 and with better coloured strains of blushed cultivars, but might probably still not favour netting.

- It's not a good idea to cover orchards on vigorous rootstocks under nets except maybe if the trees for some reason are stunted or if you like pruning very much and have a mountain of Regalis. Whereas the growth response under nets may be a benefit in the case of trees on dwarfing rootstocks, on vigorous rootstocks it results in poor colour in blushed varieties, decrease fruit quality in general and may also negatively affect total yield and the regularity of cropping.

Further net benefits not assessed in this study, but that should be part of the equation:

- It falls outside the scope of this study, but the economics of netting improves dramatically in hail-prone regions, especially for the most lucrative cultivars. This is a risk decision the producer takes together with his insurer and bank manager.
- Apart from the obvious reduction in sunlight levels under nets, netting also increases humidity and lowers wind speeds. Hence, netting may decrease irrigation needs, allow spraying for pests and diseases when conditions outside is unsuitable and allow better drying of spray chemicals. Full enclosure of orchards– like the Oak Valley Orchard of the Future – may keep out some insect pests. A net covering provides some of the same physical benefits of a mulch layer, such as buffering soil temperature and decreasing evaporation of irrigation water from the soil.
- The increase in growth in response to netting may be an aid when planting precocious dwarfing rootstocks.

Dr Simon Middleton of the Queensland Department of Agriculture, Fisheries and Forestry at Stanthorpe, Australia, did some great work on netting. Interested readers are referred to a summary of his work published in the Compact Fruit Tree as Middleton, S. & McWaters, A. 2002. Hail netting of apple orchards – Australian experience. The Compact Fruit Tree 35 (2): 51-55. The article can be accessed on the web at: http://www.virtualorchard.net/idfta/cft/2002/april/page51.pdf

Those who believe that local is *lekker* and are not afraid of thick books can request the MSc thesis of Armand Smit from the authors of this article. Armand's study was conducted under the supervision of Prof Stephanie Midgley at Stellenbosch University. Smit, A. 2007. Apple tree and fruit responses to shade netting. MScAgric, Stellenbosch University, Stellenbosch.

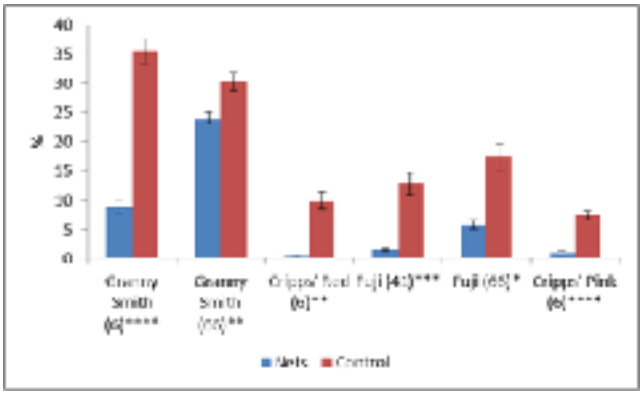

Fig 1: Sunburn as percentage of all the fruit on the tree.

(#) indicates the site number.

* Indicates the numbers of years used in the data analysis.

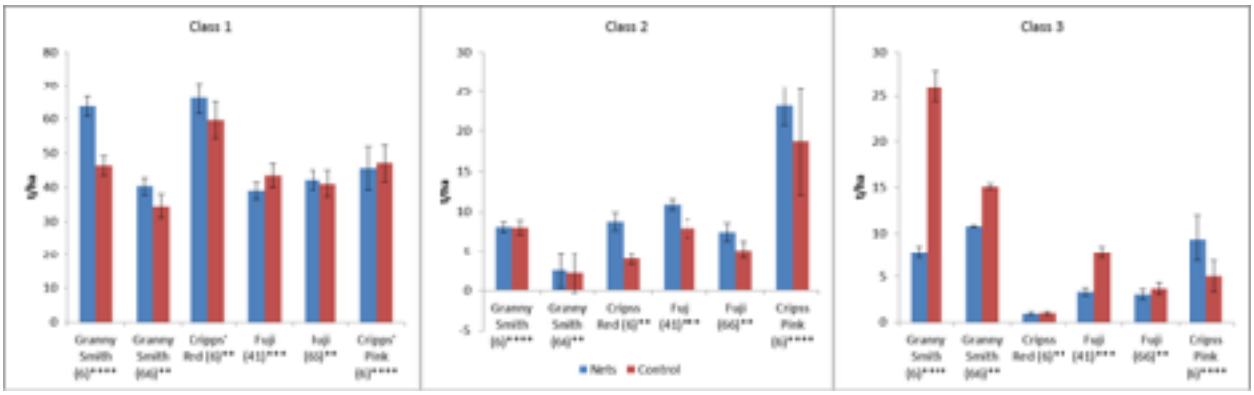

Fig 2: The class distribution of the different cultivars as affected by the treatments.

(#) Indicates the site number.

* Indicates the number of years used in the analysis.

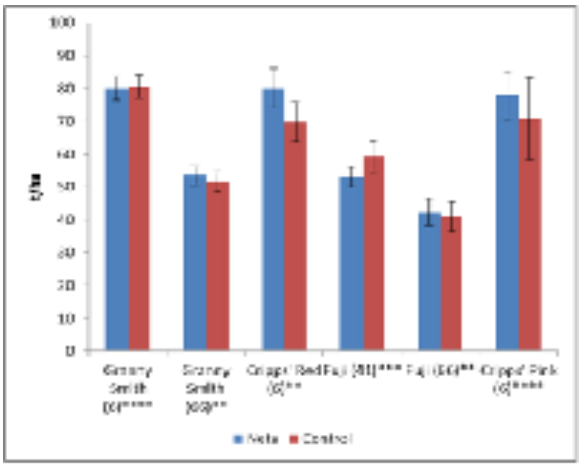

Figure 3: The effect of netting on average production of the different cultivars

(#) Indicates the site number.

* Indicates the number of years used in the analysis.

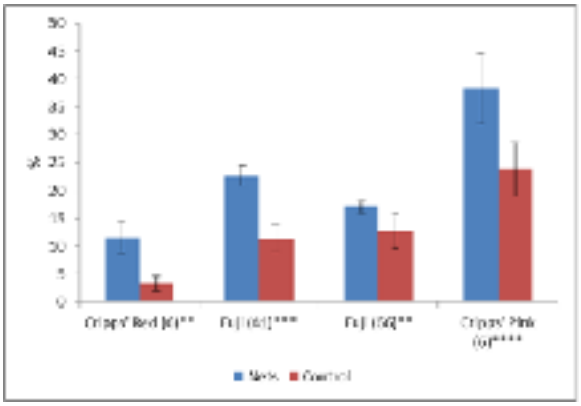

Fig 4: Fruit with inadequate red colour as percentage of all the fruit on the tree.

(#) Indicates the site number.

* Indicates the number of years used in the analysis.

Fig: Airial view of the ‘Granny Smith’, ‘Cripp’s Red’ and ‘Cripp’s Pink’ net trial at site 6. Note that the control trees are fairly sparse.

Fig : Airial view of the ‘Fuji’ net trail at site 41. Note the volume, indicative of vigour, of the control trees.